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(54) Pitch control in paper mill systems.

(57) Pitch in paper mills is controlled by treating these systems with a water soluble polymer which contains a lower alkyl N-vinyl amide or a hydrolyzed lower alkyl N-vinyl amide polymer.

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FIELD OF THE INVENTION

The invention relates to the use of certain N-vinyl amide polymers for use in controlling pitch in paper mill systems.

INTRODUCTION

The problem of pitch control in papermaking has previously been recognized. The pitch in the fibers of wood pulps is associated with naturally occurring lignin dispersing agents. Cooking and mechanical agitation which occur during the pulping by the sulfite process liberate pitch and these natural dispersing agents. But, as a result of the mechanical work on the fibers, the natural dispersing agents liberated along with the pitch are inadequate to keep the pitch from depositing on the equipment employed in beating, hydrating, refining, bleaching, and even on the wire used for forming the sheet. Because of the tendency of the pitch to agglomerate within the pulp suspension or deposit on the surfaces of the wire or other equipment, the pitch frequently causes the formation of spots or holes in the sheet formed or may adhere to the wire or press rolls or drier rolls and cause tearing of the sheet. This results in the production of sheets with numerous imperfections. Among other consequences involved are the expense of cleaning the machinery frequently either with solvents or steam, and the loss of production during cleaning and during replacing operations caused by breakdown of the sheet.

Cationic water soluble polymers are used commercially in the paper mills as pitch control agents. The present invention is predicated upon the discovery that certain water soluble lower alkyl N-vinyl amide polymers give colloidal pitch particle reduction in aqueous pulps.

THE INVENTION

The invention consists of a process for controlling pitch deposition in pulp and papermaking systems. It comprises adding to the pulp a pitch controlling amount of a water soluble polymer which contains at least 5 mole percent of a lower alkyl N-vinyl amide or hydrolized lower alkyl N-vinyl amides. The lower alkyl N-vinyl amide polymers and the hydrolized lower alkyl N-vinyl amide polymers preferred for use in the practice of the invention have average molecular weights within the range of between 5,000 - 1,000,000. Preferably the range is between 10,000 and 500,000.

THE LOWER ALKYL N-VINYL AMIDE POLYMERS

The polymers used in the practice of the invention contain at least 5 mole percent of the lower alkyl N-vinyl amide. In most instances the amount of the lower alkyl N-vinyl amide present in the polymer will be greater than 25 mole percent. The lower alkyl group of the N-vinyl amide usually contains from one to three carbon atoms. Illustrative of the lower alkyl N-vinyl amides that are present in the polymers used in the practice of the invention are N-vinyl formamide, N-vinyl acetamide and N-methyl(N-vinyl acetamide).

The other monomers present in the lower alkyl N-vinyl amide polymers may be selected from such monomeric groupings as N-vinyl amine, vinyl glycine, vinyl acetate, vinyl alcohol acrylic acid, acrylamide and N-vinyl amides having an alkyl group containing between 12-22 carbon atoms. The amount of comonomer or termonomer present in the polymers of the invention often will be controlled by the method of preparation and the effectiveness of a particular polymer in the control of pitch in a particular papermaking system.

The preparation of this polymers is frequently accomplished by the hydrolysis of a precursor lower alkyl N-vinyl amide polymer.

Depending upon the degree of hydrolysis the resulting polymer is either a polyvinyl amine (full or complete hydrolysis) or a polyvinyl amine copolymer of the starting lower alkyl N-vinyl amidewhich results from partial hydrolysis. Polymers containing vinyl alcohol groups are produced by the hydrolysis of lower alkyl N-vinyl amide-vinyl acetate copolymers. This hydrolysis often results in the production of vinyl amine groups as well as vinyl alcohol groups. Many of the lower alkyl N-vinyl amide copolymers are prepared using conventional polymerization techniques. Thus, the copolymers with acrylic acid or acrylamide are prepared in this fashion. These monomers typically are present in the copolymers in amounts ranging between 5 to 95 mole percent.

It is also possible to modify the polymers using organic modifying compounds such as alkylating agents to react with the vinyl amine containing polymers to produce secondary and tertiary amino groups. Typical is the use of chloroacetic acid to insert N-vinyl glycine groups into the molecule. It is possible to

insert fatty amide groups into the polymers by reacting N-vinyl amine groups with fatty acid chlorides which contain from 12-22 carbon atoms. Such a compound is oleyl chloride.

To illustrate typical polymers used in the practice of the invention Table 1 is presented below:

TABLE I

Polymer No.	Polymer Chemistry	MW
A	Hydrolyzed p(vinylacetamide/vinylamine) Copolymer: 80-95% vinyl acetamide 20-50% vinyl amine	60,000-150,000
B	A modified with chloroacetate: Mole % N-vinyl acetamide 80-95 N-vinyl amine 15-4 }20% of vinyl N-vinyl glycine 5-1} amine groups were modified with chloroacetate acid	60,000-150,000
C	A modified with oleyl chloride Mole % N-vinyl acetamide 80-95 N-vinyl amine 17.5-2.5 N-vinyl oleamide 2.5	60,000-150,000
D	Substantially hydrolized 1:1 p(vinyl acetate/N-methyl-N-vinyl acetamide)	10,200

In Table 1, the mole percents and the molecular weight ranges were furnished by the supplier of the N-vinyl amide or hydrolized N-vinyl amide.

DOSAGE

The Dosage and Utilization of the Polymers of the Invention

The polymers of the present invention can be added to the pulp at any stage of the papermaking system. They usually can be added as an aqueous solution. The effective amount of these polymers to be added depends on a number of variables, including the pH of the system, hardness, temperature, and the pitch content of the pulp. Generally between 0.01-1 pound per ton of the composition is added based on the weight of the pulp slurry. Good results are often achieved at a dosage of between 0.05-0.5 pound per ton.

The polymers of the instant invention are effective in controlling pitch deposition in papermaking systems, such as Kraft, acid sulfite, and mechanical pulp papermaking systems. For example, pitch deposition in the brown stock washer, screen room and decker systems in Kraft papermaking processes can be controlled. The term "papermaking" is meant to include all pulp processes. Generally, it is thought that the polymers can be utilized to prevent pitch deposition on all wetted surfaces from the pulp mill to the reel of the paper machine under a variety of pHs and conditions. More specifically, these polymers effectively decrease the deposition of metal soap and other resinous pitch components not only on the metal surfaces, but also on plastic and synthetic surfaces such as machine wires, felts, foils, uhle boxes and headbox components.

EVALUATION OF THE INVENTION

Pitch Deposition Test Procedure

It was found that pitch could be made to deposit from a 1.4% consistency hardwood kraft fiber slurry containing approximately 1,650 ppm of a laboratory pitch and approximately 300 ppm calcium hardness (as $CaCo_3$) by adjusting the slurry to the desired test pH (4.5 or 6.0), adding the appropriate amount of inhibitor chemical and mixing the fiber slurry in an Osterizer blender for 4 minutes. The deposit was determined by the difference between the starting weight of a Teflon coupon suspended into the slurry during the test, and the dried weight of the coupon plus deposited pitch after completion of the test. The laboratory pitch was comprised of a mixture of primarily resin acids, fatty acids, and fatty esters.

Listed below are Tables 2 and 3 which show the polymers which were evaluated and demonstrated pitch control activity.

TABLE 2
INHIBITION OF PITCH DEPOSITION
SOFTWOOD PITCH @ pH 4.5

POLYMER TABLE 1	DOSAGE ACTIVES	LB/TON BASIS	PITCH WEIGHT	DEPOSIT (MG)	% INHIBITION OF PITCH DEPOSITION
Control-1		0.00		520	
Control-2		0.00		489	
Control-3		0.00		473	
A		0.20		340	31
A		0.50		314	37
A		0.80		201	59
A		1.20		164	67
A		1.60		114	77
A		2.00		51	90
C		0.20		471	5
C		0.50		239	52
C		0.80		189	62
C		1.20		89	82
D	—	0.20	–	470	5

POLYMER TABLE 1	DOSAGE ACTIVES	LB/TON BASIS	PITCH WEIGHT	DEPOSIT (MG)	% INHIBITION OF PITCH DEPOSITION
D		0.50		215	57
D		1.00		138	72
D		1.50		62	87
Control-4		0.00		497	
B		0.50		524	-6
B		1.20		329	33
B		2.00		237	52
B		3.00		180	64
B		4.00		84	83
Control-5		0.00		492	
Control-6		0.00		504	

Average Control Pitch Deposit Weight = 495.8
1 Standard Deviation = 15.7 MG (3.2%)

TABLE 3
INHIBITION OF PITCH DEPOSITION
SOFTWOOD PITCH @ pH 6.0

POLYMER TABLE 1	DOSAGE ACTIVES	LB/TON BASIS	PITCH WEIGHT	DEPOSIT (MG)	% INHIBITION OF PITCH DEPOSITION
Control-1		0.00		610	
Control-2		0.00		581	
A		0.20		365	37
A		0.50		118	80
A		0.80		85	85
A		1.20		22	96
C		0.20		324	44
C		0.50		103	82
C		0.80		33	94
D		0.20		270	53
D		0.30		73	87
D		0.50		46	92
Control-3		0.00		581	
B		0.20		529	18
B		0.50		366	37
B		1.20		116	80
B		1.80		77	87
Control-4		0.00		544	

Average Control Pitch Deposit Weight = 579

1 Standard Deviation = 27.0 MG (4.7%)

Claims

1. A process for controlling pitch deposition in pulp and papermaking systems which comprises adding to the pulp a pitch controlling amount of a water soluble polymer which contains at least 5 mole percent of a lower alkyl N-vinyl amide or a hydrolyzed lower alkyl N-vinyl amide polymer.

2. The process of Claim 1 where the lower alkyl N-vinyl amide is N-vinyl formamide.

3. The process of claim 1 where the lower alkyl N-vinyl amide is N-vinyl acetamide.

4. The process of Claim 1 where the lower alkyl N-vinyl amide is N-methyl(N-vinyl acetamide).

5. The process of Claims 1 to 4 where the lower alkyl N-vinyl amide polymer contains from 5 to 95 mole percent of at least one monomer from the group consisting of vinyl amine, vinyl glycine, an N-vinyl amide having an alkyl group of from 12 to 22 carbon atoms, vinyl acetate,vinyl alcohol, acrylic acid and acrylamide.

6. The process of Claims 1 to 4 where the lower alkyl N-vinyl amide polymer is partially hydrolyzed.

7. The process of Claims 1 to 4 where the hydrolized lower alkyl N-vinyl amide polymer is completely hydrolyzed.

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EUROPEAN SEARCH REPORT

Application Number
EP 94 11 6586

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
X	EP-A-0 249 891 (BASF AKTIENGESELLSCHAFT) * the whole document * ---	1-5	D21H21/02 D21C9/08
A	FR-A-2 360 715 (ROHM AND HAAS COMPANY) * page 5, line 16 - page 6, line 22; claims * -----	1-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D21H
D21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 January 1995	Songy, O

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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